Role of El Niño Southern Oscillation in Extreme Event Related Adverse Health Outcomes in Maryland, USA

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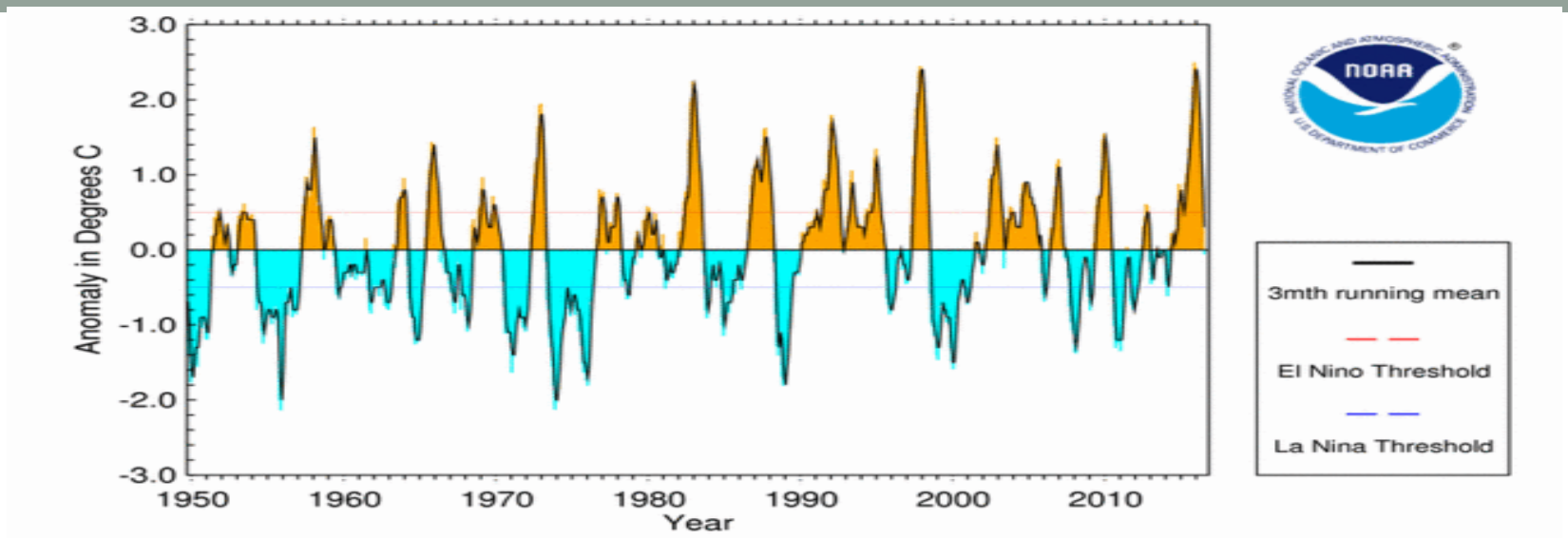
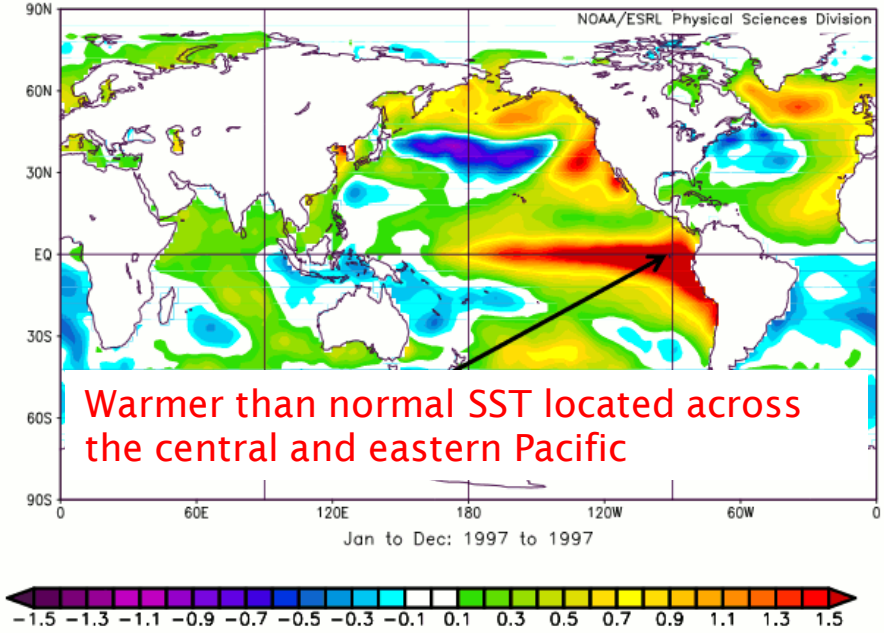
Background

- Extreme weather events are becoming more frequent, more intense and longer lasting, in response to changing climate. (*Field et al 2012*)

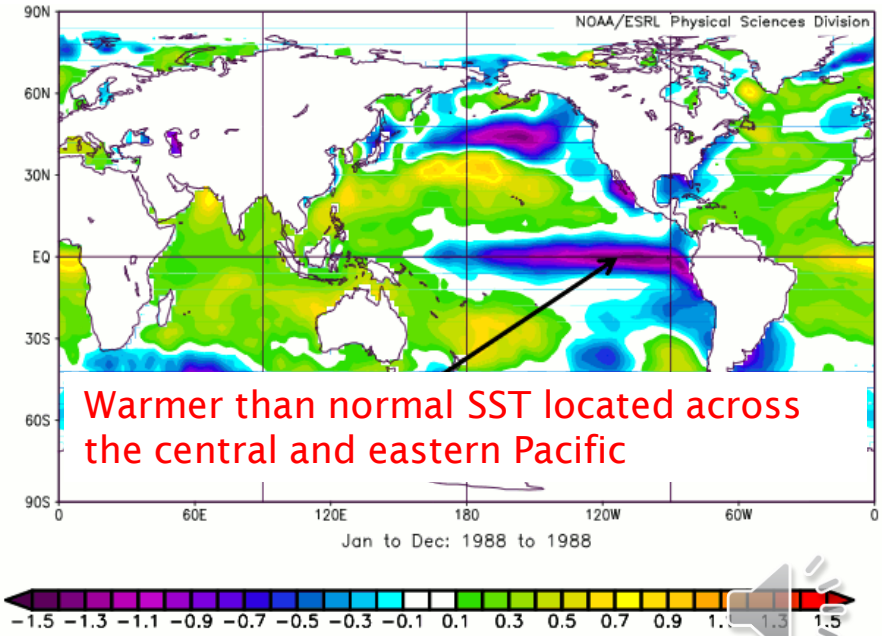
- Previous studies have linked exposures to extreme heat and extreme precipitation events with host of adverse health outcome (*Jiang et al 2015, Sonja et al 2016*)



El Niño



La Niña



http://climate.ncsu.edu/climate/patterns/ENSO.html

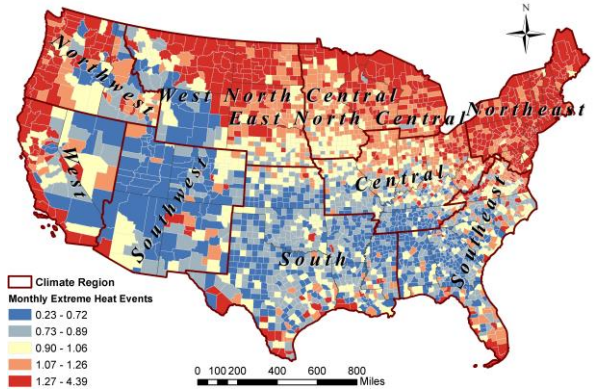
https://www.ncdc.noaa.gov/teleconnections/enso/indicators/sst.php

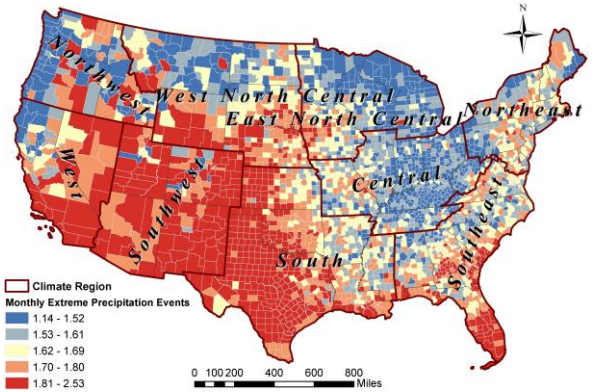
Spatial Pattern of Extreme Events by Phases of ENSO

Extreme Heat

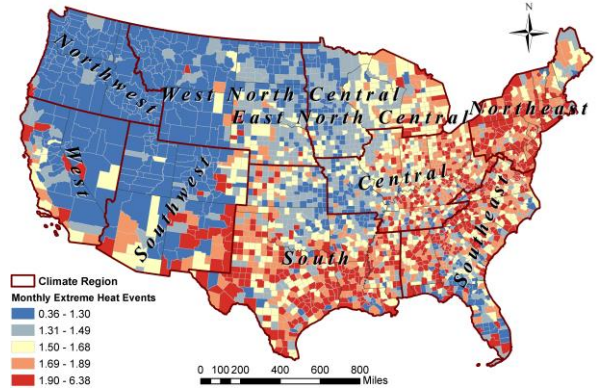
Extreme Precipitation

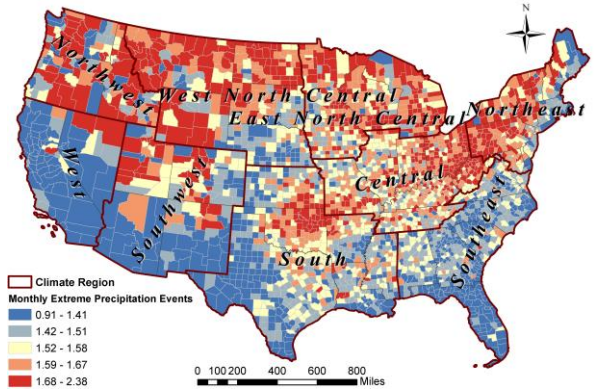
El Niño





La Niña





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Jiang et al 2016 (In Prep)

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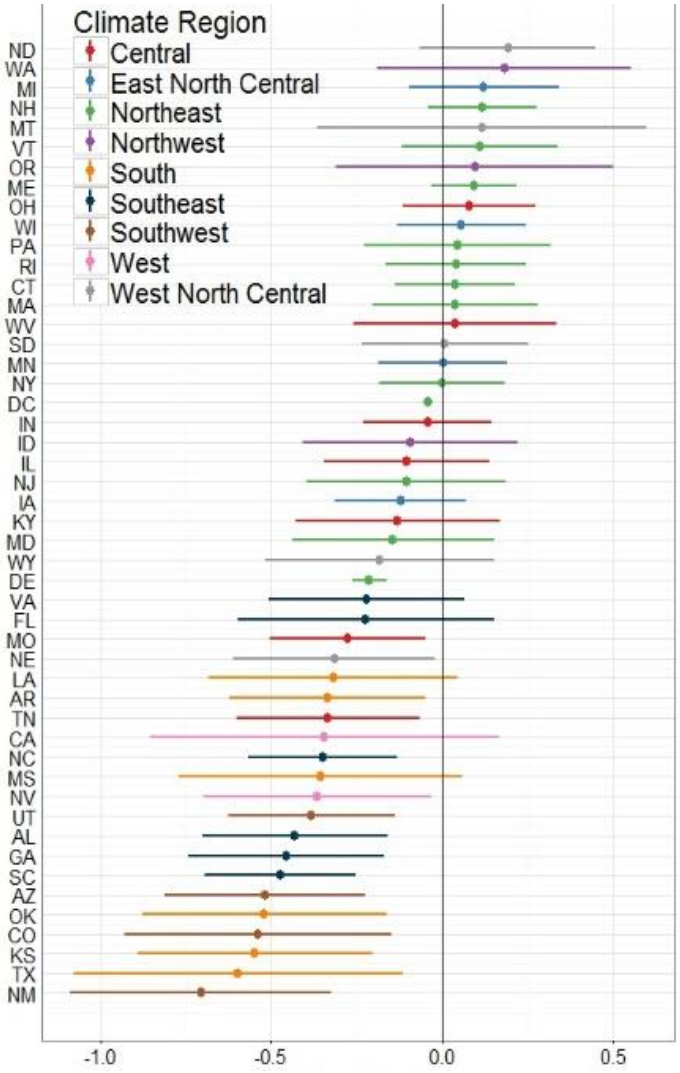
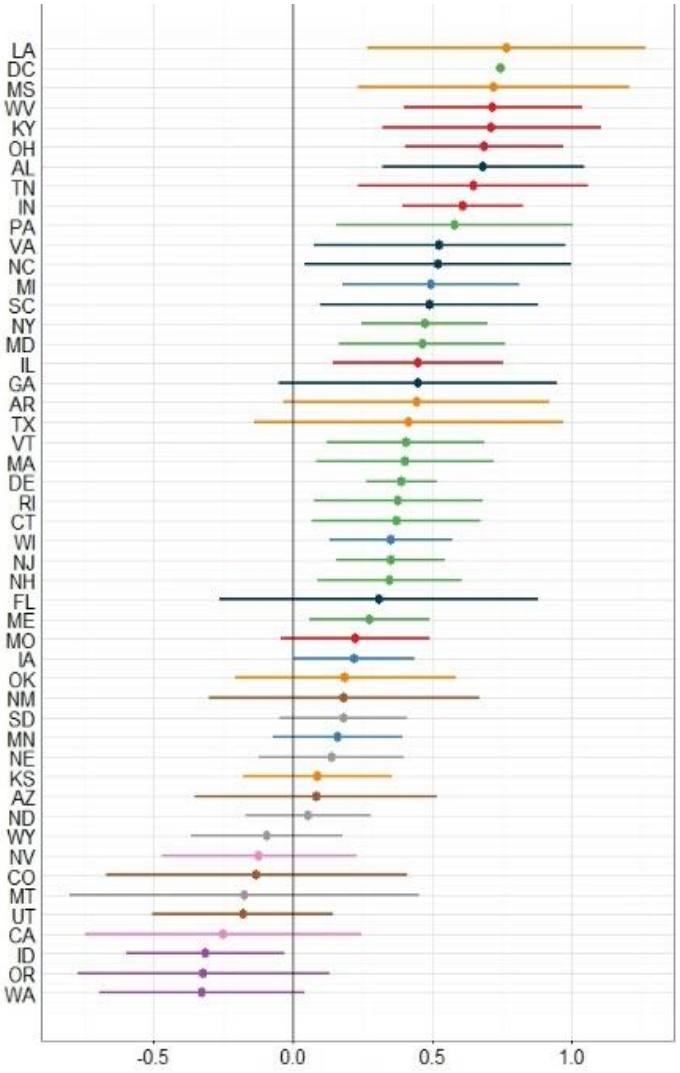
Difference in Extreme Heat Events Across State

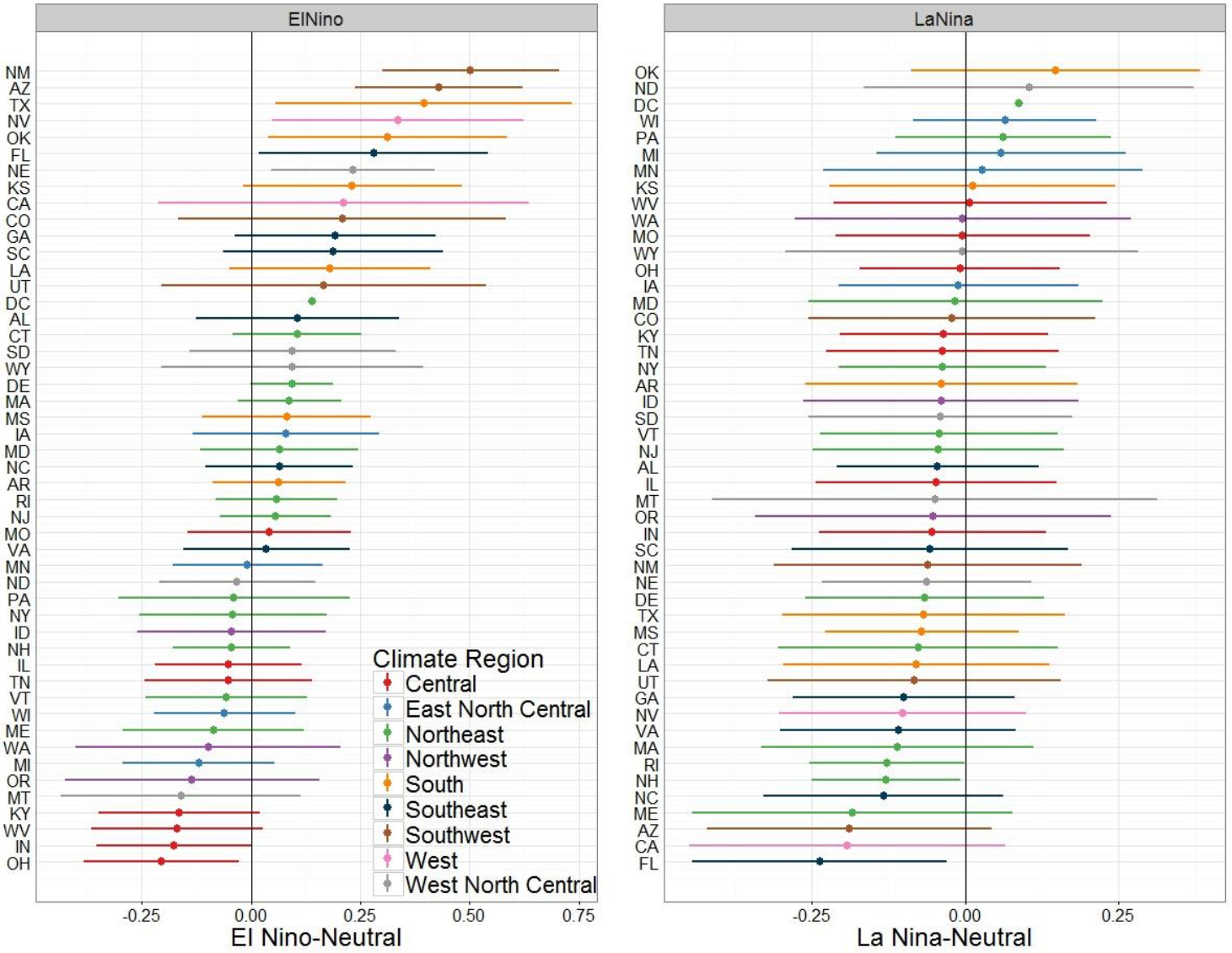


El Niño – ENSO Neutral



La Niña – ENSO Neutral

Difference in Extreme Precip Events Across State

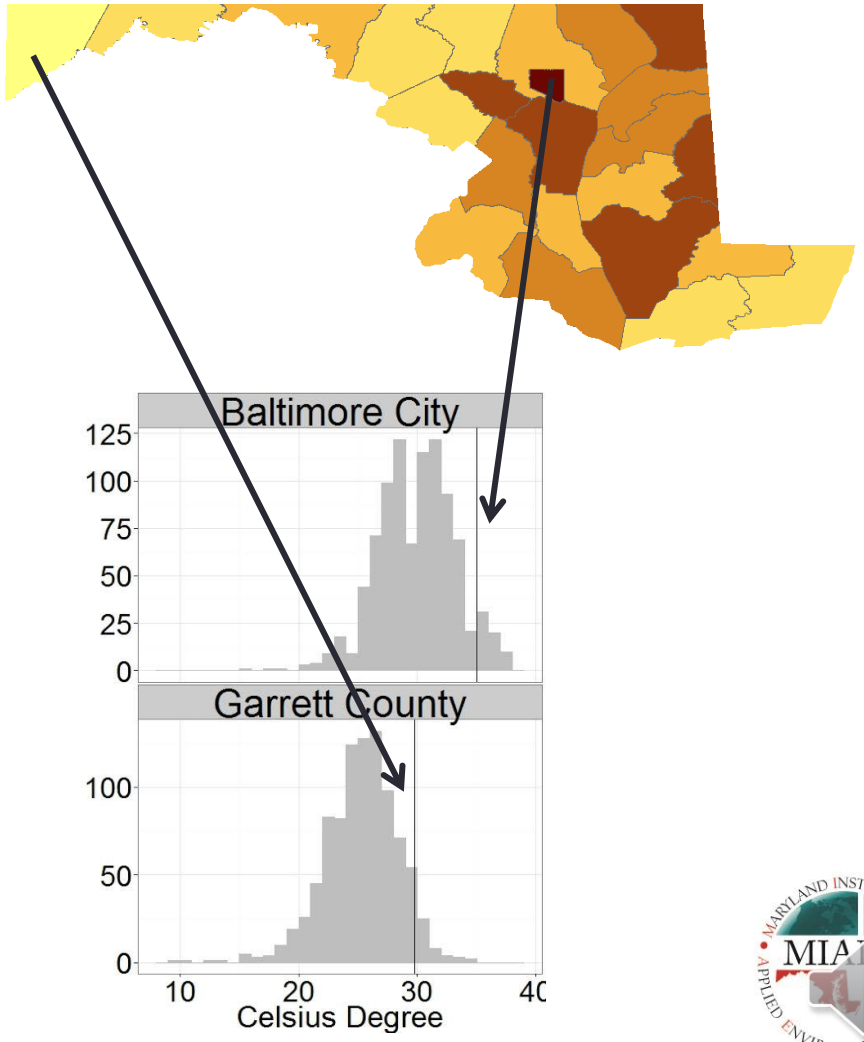


ENSO's impact on health?

Methods: Extreme Heat Events in MD

- **County and calendar day specific "climate" information derived using 30 year of daily weather observations (1960-1989).**
- **95th percentile of this distribution used as a threshold to identify extreme heat events for the study period (2001-2013)**

Example: ETT95 values on July 15th
(Range: 30-36 C)



Methods: Extreme Heat Events in MD

- **County and calendar day specific "climate" information derived using 30 year of daily weather observations (1960-1989).**
- **95th percentile of this distribution used as a threshold to identify extreme heat events for the study period (2001-2013)**
- **Threshold used to define extreme heat varies by county and by day**

Example: ETT95 values on July 15th
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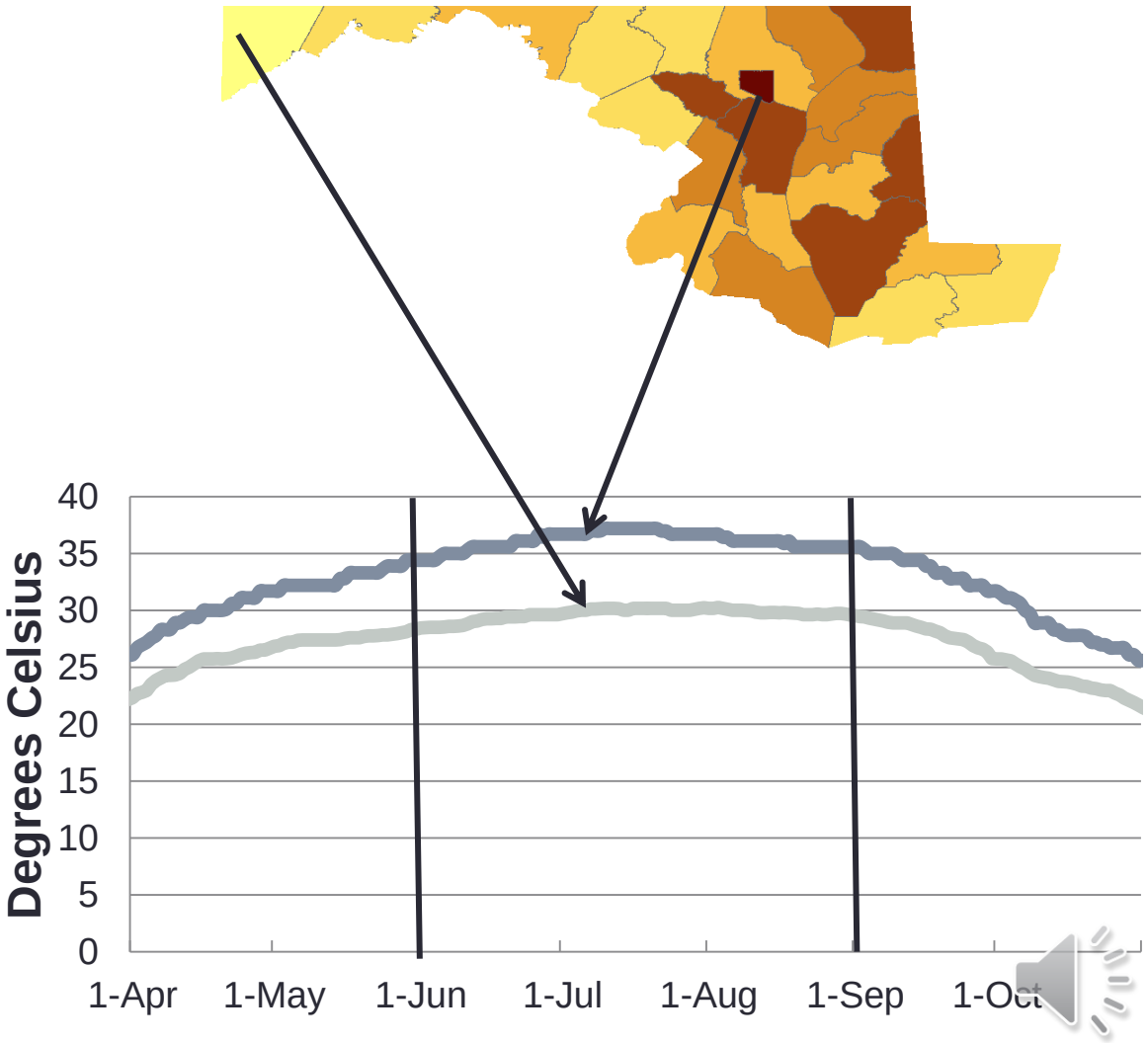


Methods

Sources of Data

- Hospitalization Data (2000-2012)
  - Maryland Department of Health and Mental Hygiene
    - *Asthma, N= 116,470*
    - *Myocardial Infarction, N = 138,343*
- Foodborne Illness (2002-2012)
  - Maryland Foodborne Diseases Active Surveillance Network (FoodNet)
    - *Culture confirmed Campylobacter infections, N*=4,804
    - *Culture confirmed Salmonella infections, N*=9,527
- Statistical Analysis
  - Hospitalization for asthma and AMI: Time-stratified case-crossover, with 3 control periods (7,14, 21 days before/after).
  - *Salmonella* infection: Negative binomial generalized estimating equations.

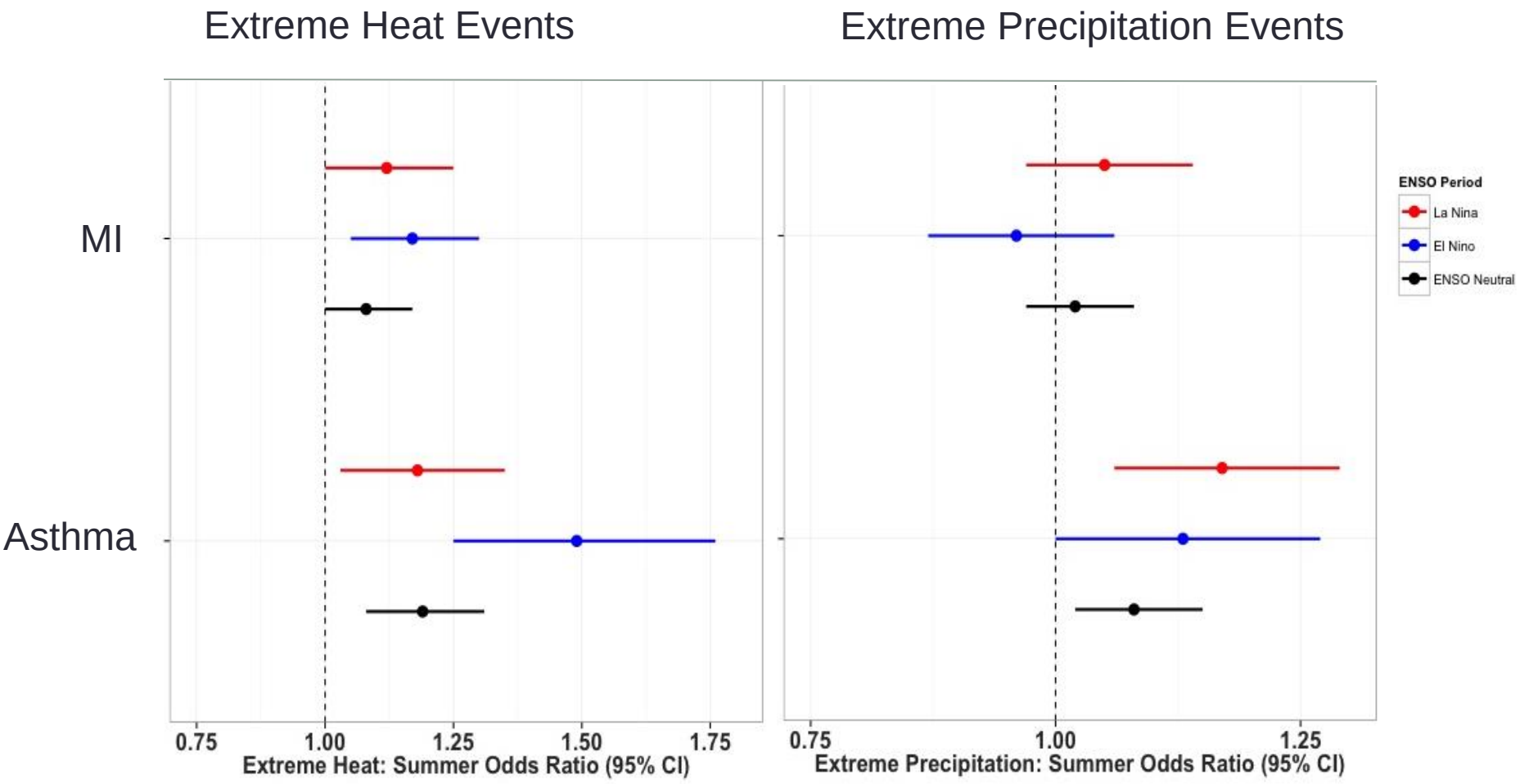
Case distribution by ENSO Events

Outcome	Time of Year	Phases of ENSO			
		El Niño	La Niña	Neutral	Total
Asthma	Summer Only	3,483	4,214	13,079	20,776
	Overall	26,754	33,441	55,728	115,923
Myocardial Infarction	Summer Only	6,257	6,737	19,680	32,674
	Overall	30,997	38,643	68,703	138,343
Campylobacteriosis*	Summer Only	370	315	1,283	1,968
	Overall	1,112	1,060	2,632	4,804
Salmonellosis*	Summer Only	870	761	2,146	3,777
	Overall	2,432	2,291	4,804	9,527

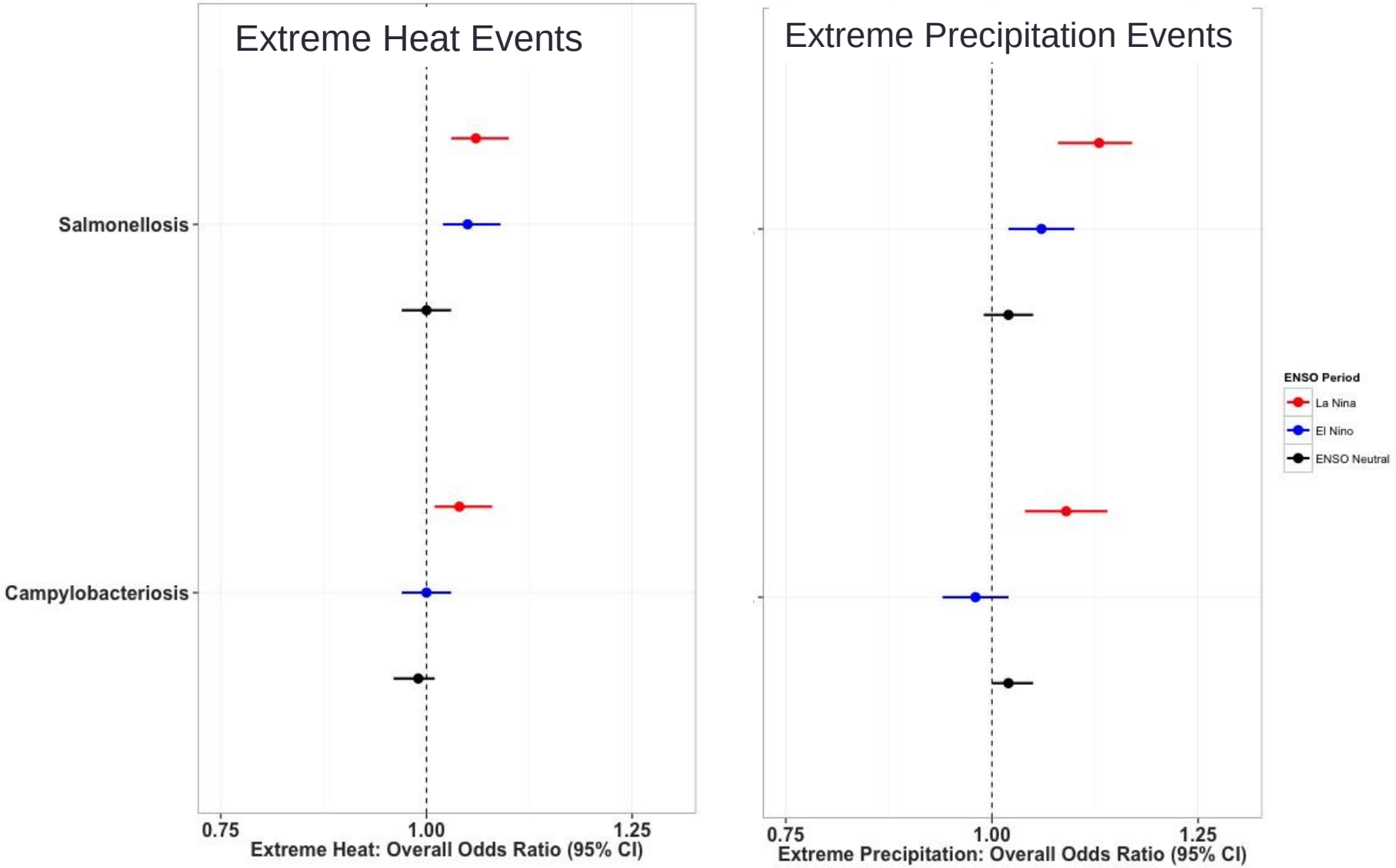
Case distribution by ENSO Events

Outcome	Extreme Heat Events	Extreme Precipitation Events
MI Hospitalization	1.11 (1.05-1.17)	0.99 (0.97-1.02)
Asthma Hospitalization	1.23 (1.15-1.33)	1.11(1.06-1.17)
Salmonellosis	1.04(1.01-1.07)	1.06(1.03-1.08)
Campylobacteriosis	1.00 (0.98-1.02)	0.98 (0.96-1.02)

Results


Extreme Heat Events
Extreme Precipitation Events
MI
Asthma
ENSO Period
La Nina
El Nino
ENSO Neutral
0.75
1.00
1.25
1.50
1.75
Extreme Heat: Summer Odds Ratio (95% CI)
0.75
1.00
1.25
Extreme Precipitation: Summer Odds Ratio (95% CI)

Results: Foodborne Illness



Recap

- Suggestive evidence that the association between extreme events and the selected 4 health outcomes ***in Maryland*** vary by phases of ENSO.

Looking ahead

- Inclusion of additional states with stronger ENSO-Extreme Event signal.
- Inclusion of additional health outcomes including stroke and injuries

Acknowledgements

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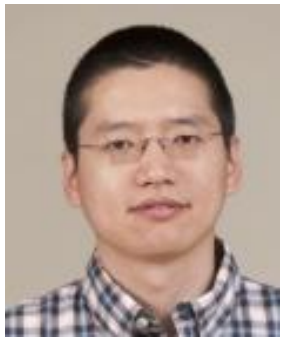

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